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Application No.: 10/699,327
Office Action Dated: June 20, 2007

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PROCEDURE PURSUANT TO
37 CFR § 1.116

This listing of claims will replace all prior versions, and listings, of claims in the application.

Listing of Claims:

1. (Currently amended) ~~A computer-implemented~~ In a compiler, a method of determining a target type in an expression with an undefined operator, comprising the steps of:

determining as said target type a most encompassed type from among a first set of types, where said first set of types comprises all resulting types of all first variant expressions, where each of said first variant expressions comprises said target expression with at least one of said operands replaced using widening type conversion, if said first set is not empty;

if said first set is empty, determining as said target type a most encompassing type from among a second set of types, where said second set of types comprises all resulting types of all second variant expressions, where each of said second variant expressions comprises said target expression with at least one of said operands replaced using at least one of widening and narrowing type conversion; and

associating said target type with said undefined operator.

2. (Previously presented) The method of claim 1, where said operands comprise n operands O_1 through O_n, where n is greater than or equal to one, and where each operand O_m is of a specific type T_m, where said step of determining as said target type said most encompassed type from among said first set of types comprises:

calculating said first set comprising types resulting from the operation of said operator on any possible set of hypothetical operands HO_1 through HO_n, where each hypothetical operand HO_m is of a type to which there is a widening conversion from type T_m ; and

if said first set is not empty, determining as said target type a most encompassed type from among said first set.

3. (Previously presented) The method of claim 2, wherein

if said first set is empty, calculating a second set comprising types resulting from the operation of said operator on any possible set of hypothetical operands HO_{n+1} through HO_{n+n},

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where each hypothetical operand HO_{n+m} is of a type to which there is a conversion, either narrowing or widening, from type T_m; and

determining as said target type a most encompassing type from among said second set.

4. (Previously presented) The method of claim 2, said method further comprising:

converting each of said operands O_1 through O_n to said target type; and

computing said operation on said converted operands O_1 through O_n.

5. (Original) The method of claim 2 where said operator is a binary operator and n equals two.

6. (Original) The method of claim 2 where said operator is a unary operator and n equals one.

7. (Original) The method of claim 1 where said target type is an intrinsic type.

8. (Currently amended) A computer implemented In a compiler, a method of resolving an expression comprising an overloaded binary operator, a first operand of a first type and a second operand of a second type, comprising the steps of:

determining a first set of types, where said first set comprises all types to which there is a widening conversion from said first type;

determining a second set of types, where said second set comprises all types to which there is a widening conversion from said second type;

determining a third set of types, where said third set comprises all types which result from the operation of said overloaded binary operator on a type from among said first set and a type from among said second set;

if said third set of types is empty, determining a fourth set of types, where said fourth set comprises all types to which there is a narrowing conversion from said first type and all types to which there is a widening conversion from said first type;

if said third set of types is empty, determining a fifth set of types, where said fifth set comprises all types to which there is a narrowing conversion from said second type and all types to which there is a widening conversion from said second type;

if said third set of types is empty, determining a sixth set of types, where said sixth set comprises all types which result from the operation of said overloaded binary operator on a type from among said fourth set and a type from among said fifth set;

if said third set of types is not empty, selecting the most encompassed type in said third set as a target type; and

if said third set of types is empty, selecting the most encompassing type in said sixth set of types as said target type; and

associating said target type with said overloaded operator.

9.   (Original) The method of claim 8, said method further comprising:

converting said first operand to said target type;

converting said second operand to said target type; and

computing said operation on said converted first operand and said converted second operand.

10.   (Currently amended) A computer-readable storage medium containing computer executable instructions for a compiler to resolve a target expression comprising an operator and at least one operand, the computer-executable instructions to perform acts comprising:

determining as a target type a most encompassed type from among a first set of types, where said first set of types comprises all resulting types of all first variant expressions, where each of said first variant expressions comprises said target expression with at least one of said operands replaced by a widening type conversion, if said first set is not empty;

if said first set is empty, determining as said target type a most encompassing type from among a second set of types, where said second set of types comprises all resulting types of all second variant expressions, where each of said second variant expressions comprises said target

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expression with at least one of said operands replaced using at least one of widening and narrowing type conversion; and

associating said target type with said undefined operator.

11.   (Previously presented) The computer-readable storage medium of claim 10, where said operands comprise n operands O_1 through O_n, where n is greater than or equal to one, and where each operand O_m is of a specific type T_m, where said act of determining as said target type said most encompassed type from among said first set of types comprises:

calculating said first set comprising types resulting from the operation of said operator on any possible set of hypothetical operands HO_1 through HO_n, where each hypothetical operand HO_m is of a type to which there is a widening conversion from type T_m ; and

if said first set is not empty, determining as said target type a most encompassed type from among said first set.

12.   (Previously presented) The computer-readable storage medium of claim 11, wherein:

if said first set is empty, calculating a second set comprising types resulting from the operation of said operator on any possible set of hypothetical operands HO_{n+1} through HO_{n+n}, where each hypothetical operand HO_{n+m} is of a type to which there is a conversion, either narrowing or widening, from type T_m; and

determining as said target type a most encompassing type from among said second set.

13.   (Previously presented) The computer-readable storage medium of claim 11, said acts further comprising:

converting each of said operands O_1 through O_n to said target type; and

computing said operation on said converted operands O_1 through O_n.

14.   (Previously presented) The computer-readable storage medium of claim 11 where said operator is a binary operator and n equals two.

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15.   (Previously presented) The computer-readable storage medium of claim 11 where said operator is a unary operator an n equals one.

16.   (Previously presented) The computer-readable storage medium of claim 10 where said target type is an intrinsic type.

17.   (Currently amended) A computer-readable storage medium containing computer executable instructions for a compiler to resolve an expression comprising an overloaded binary operator, a first operand of a first type and a second operand of a second type, the computer-executable instructions to perform acts comprising:

determining a first set of types, where said first set comprises all types to which there is a widening conversion from said first type;

determining a second set of types, where said second set comprises all types to which there is a widening conversion from said second type;

determining a third set of types, where said third set comprises all types which result from the operation of said overloaded binary operator on a type from among said first set and a type from among said second set;

if said third set of types is empty, determining a fourth set of types, where said fourth set comprises all types to which there is a narrowing conversion from said first type and all types to which there is a widening conversion from said first type;

if said third set of types is empty, determining a fifth set of types, where said fifth set comprises all types to which there is a narrowing conversion from said second type and all types to which there is a widening conversion from said second type;

if said third set of types is empty, determining a sixth set of types, where said sixth set comprises all types which result from the operation of said overloaded binary operator on a type from among said fourth set and a type from among said fifth set;

if said third set of types is not empty, selecting the most encompassed type in said third set as a target type; and

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if said third set of types is empty, selecting the most encompassing type in said sixth set of types as said target type; and

associating said target type with said overloaded operator.

18.   (Previously presented) The computer-readable storage medium of claim 17, said acts further comprising:

converting said first operand to said target type;

converting said second operand to said target type; and

computing said operation on said converted first operand and said converted second operand.

19.   (Currently amended) A ~~An operator resolution~~ system, comprising:

a microprocessor,

a computer readable memory, the memory containing instructions for determining a target type in an expression with an undefined operator, further comprising:

~~a first set determination module for~~ determining as a target type a most encompassed type from among a first set of types, where said first set of types comprises all resulting types of all first variant expressions, where each of said first variant expressions comprises said target expression with at least one of said operands replaced by a widening type conversion, if said first set is not empty;

~~a second set determination module for,~~ if said first set is empty, determining as said target type a most encompassing type from among a second set of types, where said second set of types comprises all resulting types of all second variant expressions, where each of said second variant expressions comprises said target expression with at least one of said operands replaced using at least one of widening and narrowing type conversion; and

associating said target type with said undefined operator.

20.   (Currently amended) The ~~operator resolution~~ system of claim 19, where said operands comprise n operands O_1 through O_n, where n is greater than or equal to one, and where each

operand O_m is of a specific type T_m, where said ~~first set determination module~~ <u>determining as a</u> <u>target type a most encompassed type from among a first set of types</u> comprises:

 ~~a first set calculation module for~~ calculating said first set comprising types resulting from the operation of said operator on any possible set of hypothetical operands HO_1 through HO_n, where each hypothetical operand HO_m is of a type to which there is a widening conversion from type T_m ; and

 ~~a first set target type determination module for,~~ if said first set is not empty, determining as said target type a most encompassed type from among said first set.

21. (Currently amended) The ~~operator resolution~~ system of claim 20 wherein <u>said memory</u> <u>further comprises instructions for</u>:

 ~~a second set calculation module for,~~ if said first set is empty, calculating a second set comprising types resulting from the operation of said operator on any possible set of hypothetical operands HO_{n+1} through HO_{n+n}, where each hypothetical operand HO_{n+m} is of a type to which there is a conversion, either narrowing or widening, from type T_m; and

 ~~a second set target type determination module for,~~ if said first set is empty, determining as said target type a most encompassing type from among said second set.

22. (Currently amended) The ~~operator resolution~~ system of claim 20, ~~further comprising~~ <u>wherein said memory further comprises instructions for</u>:

 ~~an operand conversion module for~~ converting each of said operands O_1 through O_n to said target type; and

 ~~an operation computation module for~~ computing said operation on said converted operands O_1 through O_n.

23. (Currently amended) The ~~operator resolution~~ system of claim 20 where said operator is a binary operator and n equals two.

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PROCEDURE PURSUANT TO
37 CFR § 1.116

24.   (Currently amended) The ~~operator resolution~~ system of claim 20 where said operator is a unary operator and n equals one.

25.   (Currently amended) The ~~operator resolution~~ system of claim 19 where said target type is an intrinsic type.

26.   (Currently amended) A ~~An operator resolution~~ system ~~resolving an expression comprising an overloaded binary operator, a first operand of a first type and a second operand of a second type,~~ comprising:

a microprocessor,

a computer readable memory, the memory containing instructions for resolving an expression comprising an overloaded binary operator, a first operand of a first type and a second operand of a second type, further comprising:

~~a first set determination module for~~ determining a first set of types, where said first set comprises all types to which there is a widening conversion from said first type;

~~a second set determination module for~~ determining a second set of types, where said second set comprises all types to which there is a widening conversion from said second type;

~~a third set determination module for~~ determining a third set of types, where said third set comprises all types which result from the operation of said overloaded binary operator on a type from among said first set and a type from among said second set;

~~a fourth set determination module for,~~ if said third set of types is empty, determining a fourth set of types, where said fourth set comprises all types to which there is a narrowing conversion from said first type and all types to which there is a widening conversion from said first type;

~~a fifth set determination module for,~~ if said third set of types is empty, determining a fifth set of types, where said fifth set comprises all types to which there is a narrowing conversion from said second type and all types to which there is a widening conversion from said second type;

~~a sixth set determination module for,~~ if said third set of types is empty, determining a

sixth set of types, where said sixth set comprises all types which result from the operation of said overloaded binary operator on a type from among said fourth set and a type from among said fifth set;

a most encompassed type selection module for, if said third set of types is not empty, selecting the most encompassed type in said third set as a target type; and

a most encompassing type selection module for, if said third set of types is empty, selecting the most encompassing type in said sixth set of types as said target type; and

associating said target type with said overloaded operator.

27.   (Currently amended) The operator resolution system of claim 26, further comprising wherein said memory further comprises instructions for:

a first operand conversion module for converting said first operand to said target type;

a second operand conversion module for converting said second operand to said target type; and

an operation computation module for computing said operation on said converted first operand and said converted second operand.